Input Instruction for WRA

1. Control File

The Control File consists of a header followed by a sequence of control-parameter items specified in the Modular Modeling System Data File format. Table 1 list the parameters required for WRA specified in the Control File.

Table 1. Parameters required for WRA specified in the Control File

Parameter Name	Definition	Data Type	Default Value
wra_module	Module name for which WRA mode will be used (auto_wra, man_wra,none). auto_wra: automatic irrigation is used. man_wra: user-defined irrigation amount is used. none: WRA module is not activated.	4	none
wra_file	Pathname for the WRA master file	4	test.wra

2. WRA Master File

A WRA master file contains four sections:

- Global options for WRA
- Allocation cycle time period definition
- Input / output files
- HUR cell index

(1) Global option section

Table 2 lists the global options for WRA. In WRA, the simulation time is broken up into stress periods and allocation cycles. A stress period contains several allocation cycles.

Table 2. Parameters in the global option section

Parameter Name	Definition	Data Type	Default Value
num_wra_sp	Number of WRA stress period	1	Optional
num_wra_cycle	Number of allocation cycles	1	Optional
num_cycle_len	Maximum length of a cycle.	1	366
num_man_obj	Number of management objects	1	Optional
drawdown_constraint	Flag to determine if groundwater drawdown constraint is activated. (1 = yes, 0 = no)	1	0
gw_compensate	Flag to determine if groundwater is supplementary to surface water deficit. (1 = yes, 0 = no)	1	1
water_source_priority	Flag to determine water source priority. (1 = groundwater preferred, 0 = surface water preferred,)	1	0

(2) Allocation cycle time period section

An example section is given below:

2004 1 366 1 366
2005 1 365 367 731
2006 1 365 732 1096
2007 1 365 1097 1461
2008 1 366 1462 1827
2009 1 365 1828 2192

Each row defines an allocation cycle, which includes five columns: year, stress period number, length of the cycle (in the unit of days), starting day index and end ending day index.

(3) Input / output files section

<p align="center">**Table 3.** Pathname for the files required for WRA</p>

File Name	Description
Stress period file	Contains definitions of management objects, allocation rules and constraints
Summary File	Summarize water allocation information

Management Objects Report File	Provides water allocation information for each management object on every day
Budgets Report File	WRA water budget report
Pump Report File	Pump report

(4) HRU cell index section

This section contains nhru rows, nhru is the number of HRUs. Each row has three columns: HRU ID, Row Index and Cell Index. All the index starts from 1. An example is given below:

```
1 4 29
1 4 29
2 4 30
3 4 31
4 4 32
5 4 33
```

3. WRA Stress Period File

A WRA stress period file contains two sections:

Table 4a.

Data Set	Parameter Name	Description
Data Set 1	num_irrg_obj	Number of irrigation management objects
	num_indu_obj	Number of industry management objects
Data Set 2	For each irrigation object	
Data Set 2a	oid	Object ID
	hrunum	Number of irrigated HRU
	iseg	Segment ID where diversion made
	ireach	Reach ID where diversion made
	num_well_layer	Number of pumping well layers
	inlet_type	Diversion inlet type
Data Set 2b	IHRU ID list	IHRU ID list in the irrigation object
Data Set 2c	Canal efficiency list	Canal efficiency for each IHRU
Data Set 2d	Canal area ratio	Canal area ratio is the ratio of canal area to the

	list	area of IHRU.
Data Set 2e	well_layer layer_ratio	
Data Set 2f	drawdown constraint	Maximum allowable groundwater drawdown in the units of meter
Data Set 2g	Inlet min flow	
	Inlet max flow	
	Inlet flow ratio	
Data Set 3	For each industry object	

Data Set	Parameter Name	Description
Data Set 4	For each allocation cycle	
Data Set 4a	quota_flag	An integer value for reusing or reading quota that can change each allocation cycle. If quota_flag≥ 0, then quota is specified. If quota_flag < 0, then quota from the previous allocation cycle is used.
Data Set 4b	quota	an array of positive real values used to define the daily quota for every management object. The array has 366 columns. For irrigation object, the unit of quota is mm. For industry object, the unit of quota is m^3.
Data Set 5	For irrigation objects in each allocation cycle (num_irrg_obj > 0)	
Data Set 5a	sw_ratio_flag	An integer value for reusing or reading surface water ratios that can change each allocation cycle.
	swctrl_factor_flag	An integer value for reusing or reading surface water controlling factors that can change each allocation cycle.
	gwctrl_factor_flag	An integer value for reusing or reading groundwater controlling factors that can change each allocation cycle.
	quota_id_flag	An integer value for reusing or reading quota id that can change each allocation cycle.
	plantarea_flag	An integer value for reusing or reading plant

		areas that can change each allocation cycle.
	max_pump_rate_flag	An integer value for reusing or reading daily maximum pumping rates that can change each allocation cycle.
	max_total_pump_flag	An integer value for reusing or reading maximum amount of accumulative pumping that can change each allocation cycle.
Data Set 5b	sw_ratio	An array of ratios of surface water demand to the total water demand
	swctrl_factor	An array of surface water controlling factors
	gwctrl_factor	An array of groundwater controlling factors
	quota_id	An array of quota id
	plantarea	Plant areas of each IHRU
	max_pump_rate	Daily maximum pumping rates
	max_total_pump	Maximum amount of accumulative pumping
Data Set 6	For industry objects in each allocation cycle (num_indu_obj > 0)	
Data Set 6a	sw_ratio_flag	
	swctrl_factor_flag	
	gwctrl_factor_flag	
	quota_id_flag	